Minnesota

Montana

North Dakota

South Dakota

REGIONAL
QUALITY
REPORT
2005

U.S. Hard Red Spring Wheat

the aristocrat of wheat

Hard red spring —a specialty wheat grown primarily in the Northern Plains of the United States —stands out as the aristocrat of wheat when it comes to baking bread. The high protein content and superior gluten quality of hard red spring wheat make it ideal for use in some of the world's finest baked goods. Yeast breads, hard rolls and specialty products such as hearth breads, whole grain breads, bagels and pizza crusts look and taste their best when baked with top quality spring wheat flour. Even frozen dough products are better with spring wheat because they can be stored longer than those made with lower protein wheats.

Flour mills in the United States and around the world also use hard red spring wheat extensively as a blending wheat to increase the gluten strength in a batch of flour. Adding hard red spring to lower protein wheat improves dough handling and mixing characteristics as well as water absorption. The resulting flour can be used to make an assortment of bread products as well as Chinese-type noodles.

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2005 OVERVIEW

Aided by a rapid, dry harvest, the 2005 hard red spring wheat crop has many quality traits buyers will appreciate including a regional average grade of No. 1 Northern Spring, average protein content of 14.6 percent and an average falling number of 414 seconds.

A regional yield equal to the five-year average yet 15 percent below last year's record produced a crop 10 percent smaller than in 2004, though still similar to average thanks to larger planted area. Production was more proportional across the region with potential hampered by late season heat and disease pressure. As a result of those disease pressures and heat stress during kernel fill, the 2005 crop has a higher level of total defects.

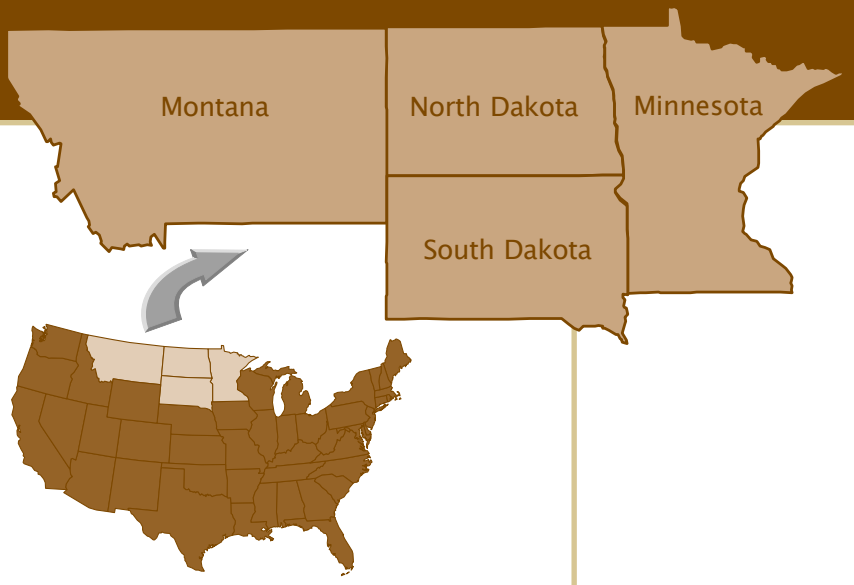
Average test weight is down from last year at 60. 2 pounds per bushel (79.1 kilograms per hectoliter), but near the five-year level. Supported by more uniform kernel size, flour extraction is up 1 percentage point over last year and the five-year average, but flour ash content is also higher.

Greater protein content in the crop translates into similar to slightly higher absorption levels in the flour, and the higher falling numbers result in improved Amylograph viscosity. However, regional average dough mixing characteristics are weaker than normal and handling properties are somewhat sticky in some areas, with increased levels of Fusarium headblight in central and eastern parts of the region likely a contributing factor. In bread baking tests, loaf volume is similar to last year but below the five-year average.

The crop shows more variability in grade and performance, especially compared to recent years when disease pressures were negligible, yet many quality parameters are still similar to or better than five-year averages. With appropriate contract specifications, especially for deoxynivalenol (DON), buyers will be able to purchase hard red spring wheat that meets the quality and value needs of their individual markets.

Cover photo: David Lipp, Fargo

Photo credit: David Lipp, Fargo



SEASONAL CONDITIONS

PLANTING began in early April ahead of normal and with few delays advanced to 90 percent complete by mid-May. By late May, seeding was complete across the region. Timely showers aided emergence resulting in excellent stands—even in the west, which was too dry at planting.

GROWING conditions were nearly ideal in May and June as normal temperatures and above normal precipitation led to excellent crop ratings and yield potential. Excessive moisture in late June and early July in central and eastern areas caused crop losses and increased crop disease pressure during flowering. Still the overall yield outlook remained above average as favorable conditions in western areas offset declines in the east.

July and August brought above normal temperatures that advanced the crop towards maturity, but also impacted kernel development in drier southwestern areas. The later portion of the crop benefitted from this drier period as disease pressures were reduced at heading. Disease pressures and the heat ultimately cut yield prospects in southern and eastern areas where crop maturity was more advanced.

HARVEST began in late July and progressed quickly as crop maturity was ahead of normal. By mid-August, over 40 percent of the spring wheat crop had been harvested, ahead of the five-year average. Favorable weather allowed for a speedy harvest, 90 percent finished by the first week of September and completed by the middle of September.

HARD RED SPRING WHEAT PRODUCTION

	2004	2005	2000-04 AVERAGE
MILLION BUSHELS			
Minnesota	89	71	86
Montana	88	82	74
North Dakota	244	224	226
South Dakota	72	68	55
Regional Total	**493**	**445**	**441**
U.S. Total	**525**	**467**	**471**
MILLION METRIC TONS			
Minnesota	2.41	1.93	2.33
Montana	2.40	2.22	2.01
North Dakota	6.64	6.11	6.16
South Dakota	1.96	1.84	1.50
Regional Total	**13.41**	**12.10**	**12.00**
U.S. Total	**14.29**	**12.71**	**12.82**

Source: USDA September 2005 Small Grains Summary

wheat characteristics

Wheat grades, as defined by the Federal Grain Inspection Service (FGIS) of the USDA Grain Inspection, Packers and Stockyards Administration (GIPSA), reflect the general quality and condition of a representative sample. U.S. grades are based on test weight and include limits on damaged kernels, foreign material, shrunken and broken kernels, and wheat of contrasting classes. Each determination is made on the basis of the grain when free from dockage.

SUBCLASSES

Subclass is a separate marketing factor based on the number of kernels with a complete, hard and vitreous endosperm, the portion that makes flour. For hard red spring wheat the subclasses are:

- **Dark Northern Spring (DNS)**—at least 75 percent or more dark, hard, vitreous kernels;
- **Northern Spring (NS)**—between 25 and 74 percent dark, hard, vitreous kernels;
- **Red Spring (RS)**—less than 25 percent dark, hard, vitreous kernels.

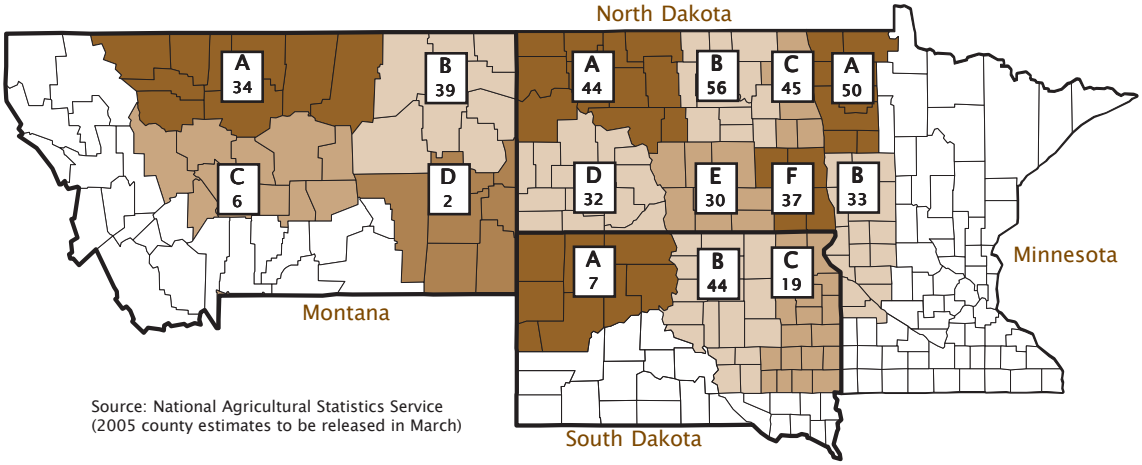
OFFICIAL U.S. GRADES AND GRADE REQUIREMENTS (Revised June 1993)

GRADING FACTORS	U.S. GRADES 1	2	3	4	5
HARD RED SPRING—MINIMUM TEST WEIGHTS					
Pounds per bushel	58.0	57.0	55.0	53.0	50.0
Kilograms per hectoliter	76.4	75.1	72.5	69.9	66.0
MAXIMUM PERCENT LIMITS OF:					
Defects					
Damaged kernels					
Heat (part of total)	0.2	0.2	0.5	1.0	3.0
Total	2.0	4.0	7.0	10.0	15.0
Foreign material	0.4	0.7	1.3	3.0	5.0
Shrunken/ broken kernels	3.0	5.0	8.0	12.0	20.0
Total[1]	3.0	5.0	8.0	12.0	20.0
Wheat of other classes[2]					
Contrasting classes	1.0	2.0	3.0	10.0	10.0
Total[3]	3.0	5.0	10.0	10.0	10.0
Stones	0.1	0.1	0.1	0.1	0.1
MAXIMUM COUNT LIMITS OF:					
Other material					
Animal filth	1	1	1	1	1
Castor beans	1	1	1	1	1
Crotalaria seeds	2	2	2	2	2
Glass	0	0	0	0	0
Stones	3	3	3	3	3
Unknown foreign substances	3	3	3	3	3
Total[4]	4	4	4	4	4
Insect-damaged kernels in 100 grams	31	31	31	31	31

U.S. Sample grade is wheat that:
(a) Does not meet the requirements for U.S. Nos. 1, 2, 3, 4, or 5; or
(b) Has a musty, sour, or commercially objectionable foreign odor (except smut or garlic odor); or
(c) is heating or of distinctly low quality.
1 Includes damaged kernels (total), foreign material, and shrunken and broken kernels.
2 Unclassed wheat of any grade may contain not more than 10.0 percent of wheat of other classes.
3 Includes contrasting classes.
4 Includes any combination of animal filth, castor beans, crotalaria

Wheat samples were obtained in Montana, North Dakota, South Dakota and Minnesota in the crop reporting areas identified in color. Samples were gathered during harvest from growers, farm bins and country elevators.

CROP REPORTING AREAS & 2004 HARD RED SPRING WHEAT PRODUCTION (million bushels)

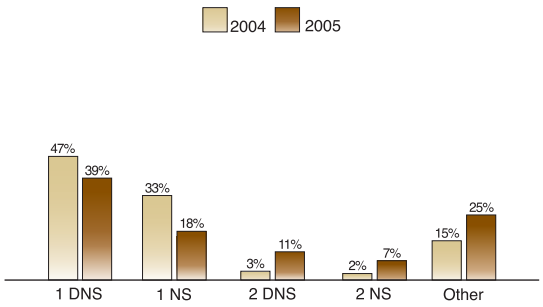


Source: National Agricultural Statistics Service
(2005 county estimates to be released in March)

OVERALL GRADE

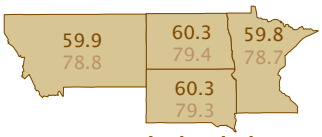
The average grade for the region is 1NS. This grade reflects the average vitreous kernel content of 68 percent. Of the 15 composite samples, four graded 1DNS, eight graded 1NS, two graded 2NS and one grade 3NS.

REGIONAL GRADE DISTRIBUTION



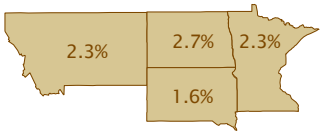
Fifty-seven percent of 2005 samples grade No. 1NS or better, down from 80 percent last year.

TEST WEIGHT BY STATE

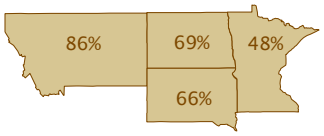


pounds/bushel
kilograms/hectoliter

AVERAGE TOTAL DEFECTS BY STATE



AVERAGE VITREOUS KERNELS BY STATE



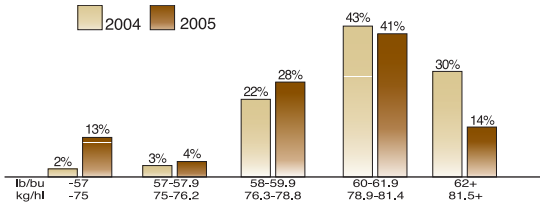
Wheat Grading Data

STATE AND CROP REPORTING AREA	TEST WEIGHT LBS/BU	TEST WEIGHT KG/HL	DAMAGE %	FOREIGN MATERIAL %	SHRUNKEN/ BROKEN KERNELS %	TOTAL DEFECTS %	CONTRASTING CLASSES %	U.S. GRADE	VITREOUS KERNELS %
MINNESOTA									
Area A	60.1	79.1	1.0	0.0	0.2	1.2	0.0	1NS	60
Area B	59.2	77.9	3.2	0.0	1.0	4.2	0.0	2NS	26
State Avg. 2005	59.8	78.7	1.8	0.0	0.5	2.3	0.0	1NS	48
State Avg. 2004	61.0	80.3	0.6	0.0	0.5	1.1	0.0	1NS	42
MONTANA									
Area A	59.3	78.0	0.0	0.0	1.9	1.9	0.0	1DNS	89
Area B	60.7	79.8	0.6	0.0	2.2	2.8	0.0	1DNS	85
Area C	58.8	77.4	0.7	0.0	2.2	2.9	0.0	1DNS	81
Area D	59.2	77.9	0.8	0.0	0.6	1.4	0.0	1NS	56
State Avg. 2005	59.9	78.8	0.3	0.0	2.0	2.3	0.0	1DNS	86
State Avg. 2004	61.1	80.4	0.0	0.0	1.8	1.8	0.0	1DNS	92
NORTH DAKOTA									
Area A	61.1	80.4	0.4	0.0	1.0	1.4	0.0	1DNS	81
Area B	60.6	79.7	1.7	0.0	1.0	2.7	0.0	1NS	72
Area C	61.1	80.4	2.0	0.0	0.8	2.8	0.0	1NS	68
Area D	59.4	78.2	0.2	0.0	2.0	2.2	0.0	1NS	66
Area E	60.0	78.9	0.6	0.3	1.2	2.1	0.0	1NS	57
Area F	59.1	77.8	4.1	0.0	1.0	5.1	0.0	3NS	61
State Avg. 2005	60.3	79.4	1.5	0.0	1.1	2.7	0.0	1NS	69
State Avg. 2004	61.3	80.6	0.9	0.0	0.7	1.5	0.0	1NS	66
SOUTH DAKOTA									
Area A	57.4	75.6	0.7	0.0	2.4	3.1	0.0	2NS	69
Area B	60.6	79.7	0.6	0.0	1.0	1.6	0.0	1NS	66
Area C	60.8	80.0	0.3	0.0	0.7	1.0	0.0	1NS	65
State Avg. 2005	60.3	79.3	0.5	0.0	1.1	1.6	0.0	1NS	66
State Avg. 2004	60.8	79.9	0.4	0.0	0.8	1.2	0.0	1NS	57
FOUR-STATE REGION									
Avg. 2005	60.2	79.1	1.2	0.0	1.2	2.4	0.0	1NS	68
Avg. 2004	61.1	80.4	0.6	0.0	0.9	1.4	0.0	1NS	65
Five-Year Avg.	60.3	79.3	0.6	0.0	1.3	1.9	0.0	1DNS	72

All state and regional averages have been adjusted to reflect production differences.

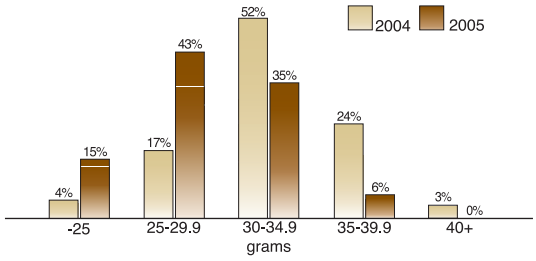
Photo credit: David Lipp, Fargo

REGIONAL TEST WEIGHT DISTRIBUTION



Eighty-three percent of 2005 samples have test weights of 58 lbs/bu (76.3 kg/hl) or greater. The regional average test weight is 60.2 lbs/bu (79.1 kg/hl), similar to the five-year average.

REGIONAL THOUSAND KERNEL WEIGHT DISTRIBUTION



Forty-two percent of 2005 samples have a thousand kernel weight of 30 grams or more. The regional average is 29.8 grams.

Other basic criteria beyond grading factors used to determine wheat's initial value in the marketing system include protein, moisture, dockage, falling number and ash content.

Protein is probably the most important factor in determining the value of hard red spring wheat since it relates to many processing properties. Prices for hard red spring wheat in the U.S. market are usually quoted for 14.0 percent protein (on a 12.0 percent moisture basis). Price premiums or discounts may be specified for halves, fifths and tenths of a percentage point above and below 14.0 percent, depending upon protein levels and distribution available to the market.

Moisture content is an indicator of grain storability. Wheat with low moisture content is more stable during storage. Moisture content also can be an indicator of profitability in milling.

Dockage is any material easily removed from a wheat sample using standard mechanical means. Dockage removal is the first step in analyzing a sample. All other factors are determined only after dockage is removed.

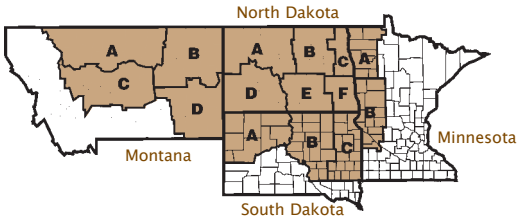
Falling number indicates the soundness of wheat or its alpha-amylase activity. Low falling numbers show high activity associated with sprout damage.

Ash content, primarily concentrated in the bran, is an indication of the yield that can be expected in milling white flour.

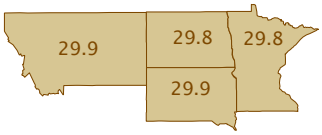
Other Kernel Quality Data

STATE AND CROP REPORTING AREA	DOCKAGE %	MOISTURE %	1000 KERNEL WEIGHT G	KERNEL DIST. MEDIUM %	KERNEL DIST. LARGE %	PROTEIN (DRY MATTER) %	PROTEIN (12% MOISTURE) %	WHEAT ASH %	FALLING NUMBER (SEC)	ZELENY SEDIMENT-ATION (CC)
MINNESOTA										
Area A	1.0	13.0	30.9	39	54	16.5	14.5	1.78	392	60
Area B	0.7	13.1	27.9	45	42	15.9	14.0	1.70	383	51
State Avg. 2005	0.9	13.0	29.8	41	50	16.3	14.3	1.75	389	57
State Avg. 2004	0.8	13.0	34.4	21	77	14.7	13.0	1.54	325	61
MONTANA										
Area A	0.6	10.6	30.4	49	35	16.6	14.6	1.64	406	64
Area B	0.7	11.3	29.0	46	44	15.8	13.9	1.67	432	59
Area C	0.7	10.3	33.4	47	35	16.6	14.6	1.72	423	61
Area D	1.4	11.2	29.7	49	38	16.0	14.0	1.61	416	62
State Avg. 2005	0.7	10.9	29.9	48	39	16.2	14.3	1.66	419	62
State Avg. 2004	0.7	11.0	31.4	40	51	16.1	14.2	1.55	396	63
NORTH DAKOTA										
Area A	1.1	13.0	30.9	35	59	16.4	14.5	1.62	407	67
Area B	1.1	12.7	30.3	39	52	16.9	14.9	1.70	411	65
Area C	0.6	12.8	29.8	40	52	17.2	15.2	1.74	391	59
Area D	1.1	11.3	28.7	44	40	16.5	14.5	1.72	434	62
Area E	0.7	12.3	29.8	43	46	16.4	14.4	1.79	417	58
Area F	1.1	12.8	28.5	42	49	16.9	14.9	1.79	404	57
State Avg. 2005	1.0	12.5	29.8	40	51	16.7	14.8	1.72	410	62
State Avg. 2004	0.8	12.7	32.8	27	70	15.6	13.9	1.53	338	64
SOUTH DAKOTA										
Area A	2.6	11.0	26.5	55	27	16.4	14.4	1.85	441	53
Area B	0.8	11.9	31.1	34	56	16.5	14.5	1.77	458	50
Area C	0.4	12.3	28.9	29	64	16.8	14.8	1.72	421	57
State Avg. 2005	0.9	11.9	29.9	35	55	16.6	14.6	1.76	445	53
State Avg. 2004	0.7	12.4	33.2	27	70	15.7	13.8	1.62	396	60
FOUR-STATE REGION										
Avg. 2005	0.9	12.2	29.8	41	49	16.5	14.6	1.72	414	60
Avg. 2004	0.8	12.4	32.9	28	68	15.6	13.8	1.55	355	63
Five-Year Avg.	1.0	12.0	30.4	34	48	16.4	14.4	1.64	366	56

All state and regional averages have been adjusted to reflect production differences.

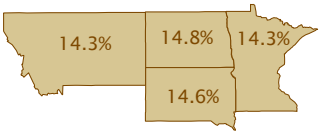


THOUSAND KERNEL WEIGHT BY STATE



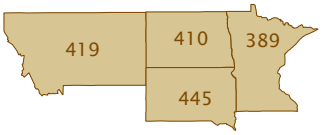
grams

AVERAGE PROTEIN BY STATE



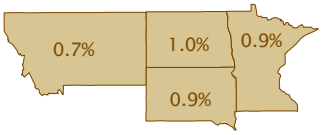
12% Moisture Basis

AVERAGE FALLING NUMBER BY STATE

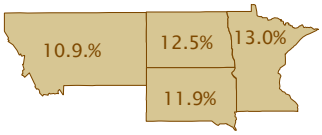


Seconds

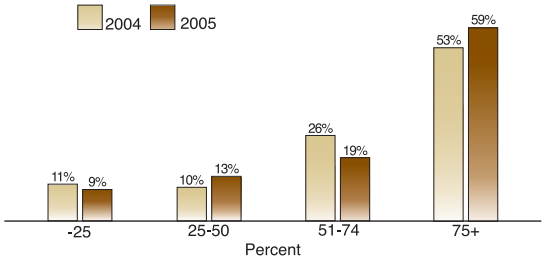
AVERAGE HARVEST DOCKAGE BY STATE



AVERAGE MOISTURE BY STATE

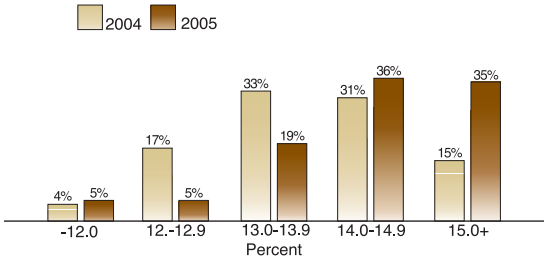


REGIONAL VITREOUS KERNEL DISTRIBUTION



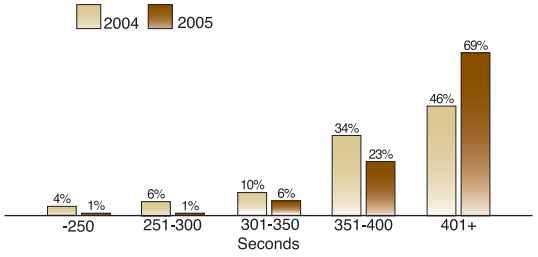
Fifty-nine percent of 2005 samples have a dark, hard vitreous kernel count of 75 percent or better.

REGIONAL PROTEIN DISTRIBUTION (12% moisture basis)



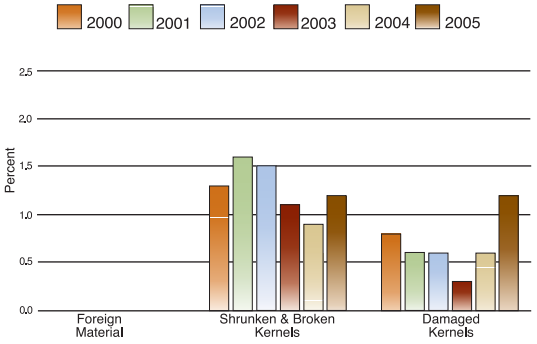
Seventy-one percent of 2005 samples have a protein content of 14.0 percent or greater, much improved from last year.

REGIONAL FALLING NUMBER DISTRIBUTION



Ninety-eight percent of the 2005 crop has a falling number of 300 seconds or greater.

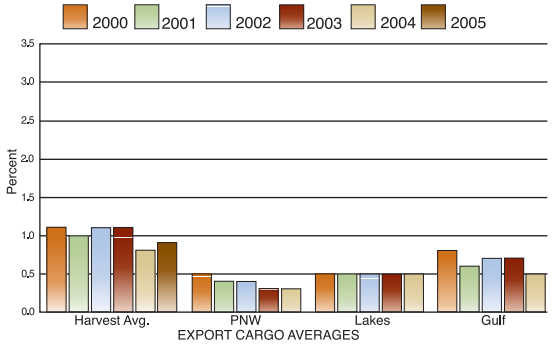
REGIONAL AVERAGE: TOTAL DEFECTS



Average total defects are 2.4 percent, an increase over last year because of higher damage levels in the crop.

Photo credit: David Lipp, Fargo

REGIONAL AVERAGE DOCKAGE CONTENT



Dockage in the 2005 harvest averages 0.9 percent. Cleaning and contract specifications help reduce dockage in export shipments.

milling characteristics

Flour is evaluated for several factors to determine overall milling efficiency, grade, soundness and functional properties.

Extraction, or the proportion of the wheat kernel that can be milled into flour, is important to mill profitability. For purposes of this survey, test milling was conducted with a Buhler laboratory mill. Results are suitable for comparison between crop years, however yields are lower than those obtained in commercial mills.

Another measure of milling efficiency and of flour grade is the ash content, or mineral residue, remaining after incineration of a sample. The lower the ash, the whiter and more refined the flour.

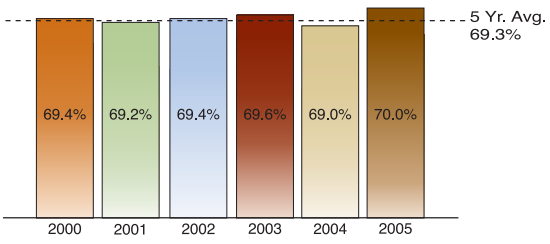
Starch damage measures physical damage to a proportion of the starch granules of flour. The level directly affects water absorption and dough mixing properties.

Photo credit: Wheat Foods Council

Wet gluten provides a quantitative measure of the gluten forming proteins in flour that are primarily responsible for its dough mixing and baking properties.

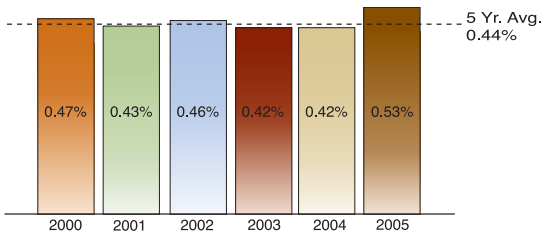
Falling number measures enzyme activity in flour. A fast time indicates high activity, revealing too much sugar and too little starch. Since starch provides bread's supporting structure, too much activity results in sticky dough and poor texture in finished products. Amylograph peak viscosity is another measure of enzyme activity.

REGIONAL AVERAGE: FLOUR EXTRACTION



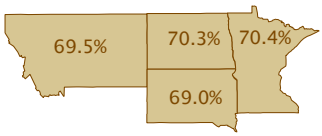
The regional average extraction is 70.0 percent, up from last year.

REGIONAL AVERAGE: ASH CONTENT

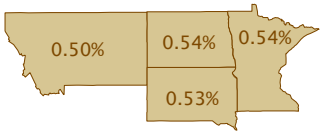


The average flour ash content is 0.53 percent, not as good as last year.

AVERAGE FLOUR EXTRACTION BY STATE

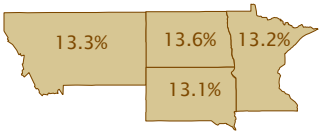


AVERAGE FLOUR ASH CONTENT BY STATE



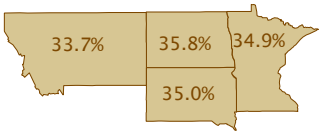
14% Moisture Basis

AVERAGE FLOUR PROTEIN CONTENT BY STATE



14% Moisture Basis

AVERAGE WET GLUTEN CONTENT BY STATE



14% Moisture Basis

Flour Quality Data

STATE AND CROP REPORTING AREA	FLOUR EXTRACTION %	FLOUR ASH %	FLOUR PROTEIN (14% MOISTURE) %	STARCH DAMAGE %	WET GLUTEN %	FALLING NUMBER SEC	AMYLOGRAPH PEAK VISCOSITY 65G FL B.U.	AMYLOGRAPH PEAK VISCOSITY 100G FL B.U.
MINNESOTA								
Area A	69.9	0.55	13.4	7.9	36.1	435	540	1800
Area B	71.3	0.53	12.8	7.8	32.8	410	660	2280
State Avg. 2005	70.4	0.54	13.2	7.9	34.9	426	583	1973
State Avg. 2004	70.1	0.40	11.6	7.9	29.9	344	417	1350
MONTANA								
Area A	69.6	0.51	13.7	8.0	34.8	435	640	2520
Area B	69.6	0.50	12.8	8.0	32.5	433	980	3360
Area C	68.1	0.52	13.6	8.2	35.4	456	800	3080
Area D	69.1	0.43	12.9	8.1	33.1	423	990	3460
State Avg. 2005	69.5	0.50	13.3	8.0	33.7	434	810	2950
State Avg. 2004	67.9	0.42	12.8	8.2	33.5	403	844	2867
NORTH DAKOTA								
Area A	71.3	0.52	13.5	7.8	34.8	409	800	2790
Area B	70.3	0.53	13.8	7.8	37.0	383	700	2310
Area C	70.3	0.55	13.8	7.6	37.2	400	555	1920
Area D	69.8	0.52	13.3	7.5	34.5	438	925	3070
Area E	69.8	0.55	13.3	7.7	35.2	409	720	2420
Area F	69.8	0.57	13.6	7.9	35.6	403	660	2200
State Avg. 2005	70.3	0.54	13.6	7.7	35.8	405	726	2450
State Avg. 2004	68.9	0.43	12.5	8.4	32.6	348	431	1350
SOUTH DAKOTA								
Area A	67.4	0.53	13.0	7.7	32.6	425	895	3320
Area B	69.6	0.54	13.1	8.0	35.2	445	800	3140
Area C	68.4	0.51	13.2	8.1	35.4	413	780	2530
S tate Avg. 2005	69.0	0.53	13.1	8.0	35.0	433	804	2971
State Avg. 2004	69.7	0.44	12.5	8.2	31.7	405	749	2657
FOUR-STATE REGION								
Average 2005	70.0	0.53	13.4	7.8	35.2	418	731	2547
Average 2004	69.0	0.42	12.4	8.3	32.2	365	549	1813
Five-Year Average	69.3	0.44	13.2	n/a	35.3	389	617	2188

All state and regional averages have been adjusted to reflect production differences.

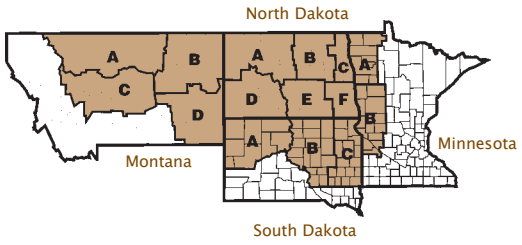
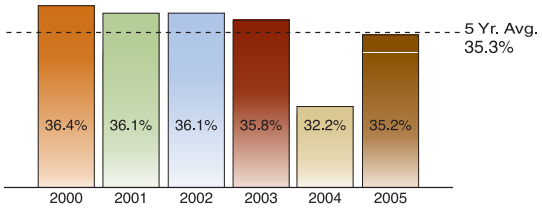


Photo credit: USDA Agricultural Research Service

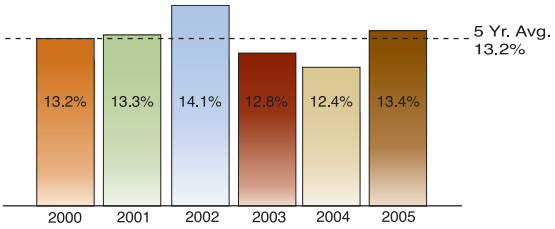
Photo credit: North Dakota Mill

REGIONAL AVERAGE: WET GLUTEN



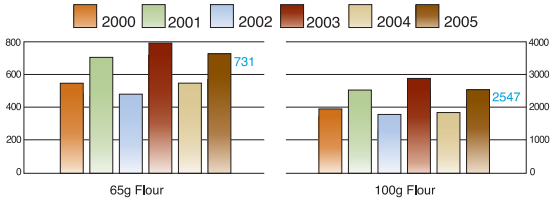
Average wet gluten content for the 2005 crop is 35.2 percent, a reflection of higher average protein content.

REGIONAL AVERAGE: FLOUR PROTEIN CONTENT



The 2005 crop produced an average flour protein content of 13.4 percent, higher than average.

REGIONAL AVERAGE AMYLOGRAPH PEAK VISCOSITY (Brabender Units)



Peak viscosity averages for 2005 are up, reflecting the overall soundness of the crop.

dough characteristics

Photo credit: Wheat Foods Council

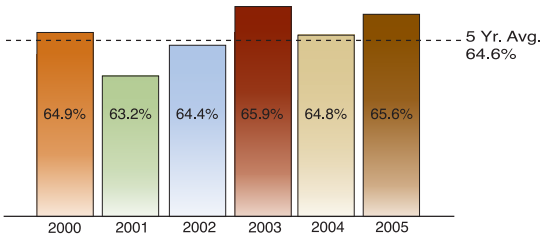
Physical characteristics of dough are evaluated to reveal useful information about variations in flour types, processing requirements and expected end-product quality.

A farinograph traces a curve during the dough mixing process to record variations in gluten development and the breakdown of gluten proteins over time. Water absorption indicates the amount of water that can be added to the flour until the dough reaches a definite consistency. Peak time indicates the number of minutes required to achieve this level of dough consistency and mixing tolerance indicates the stability of the dough. Both development time and mixing tolerance are related to dough strength. Farinograms are rated on a scale of 1 to 8, with higher values indicating strong mixing properties.

The extensograph measures dough strength by stretching a piece of dough on a hook until it breaks. The apparatus traces a curve that measures extensibility, resistance to extension and the area beneath the curve, or energy value.

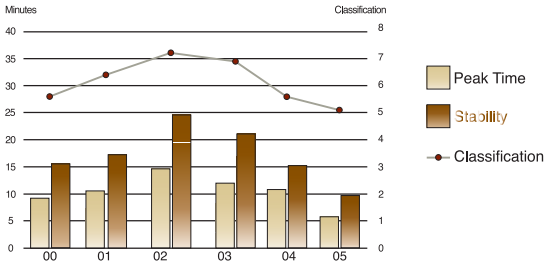
An alveograph traces a curve that measures the air pressure necessary to inflate a piece of dough to the point of rupture. The overpressure (P) value reflects the maximum pressure needed to deform the piece of dough during the inflation process and is an indication of resistance, or dough stability. The length (L) measurement reflects dough extensibility. The deformation energy (W) measurement is the amount of energy needed to inflate the dough to the point of rupture and is indicative of dough strength.

REGIONAL AVERAGE: FARINOGRAM ABSORPTION



The regional absorption is 65.6 percent, up from 2004, and the five-year average.

REGIONAL AVERAGE FARINOGRAM RESULTS

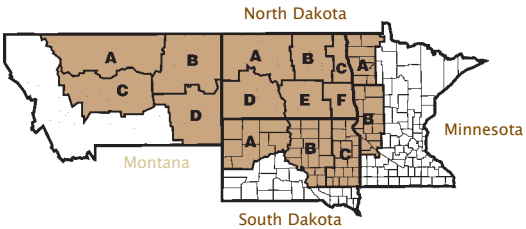


The regional average peak time is 5.7 minutes; stability, 9.9 minutes; and mixing tolerance index, 36 Brabender units; for an overall classification of 5.1 (on a 1 to 8 scale).

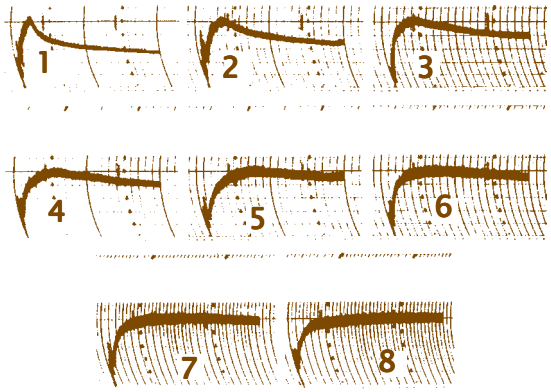
Physical Dough Properties

STATE AND CROP REPORTING AREA	FARINOGRAM ABSORPTION %	PEAK TIME MIN	STABILITY MIN	MTI B.U.	CLASSIFICATION	VALORIMETER
MINNESOTA						
Area A	65.6	6.5	9.0	50	5	62
Area B	62.4	6.5	11.5	30	6	63
State Avg. 2005	64.4	6.5	9.9	43	5.4	62
State Avg. 2004	63.3	4.4	11.4	30	4.4	54
MONTANA						
Area A	65.1	4.5	14.0	20	6	58
Area B	66.2	4.0	9.0	25	5	56
Area C	67.0	5.5	11.0	25	6	64
Area D	64.8	5.0	12.5	15	6	60
State Avg. 2005	65.6	4.3	11.6	22	5.6	57
State Avg. 2004	64.0	33.6	31.7	8	8	99
NORTH DAKOTA						
Area A	67.5	6.0	9.5	35	5	62
Area B	66.5	6.0	9.0	45	5	62
Area C	66.3	6.0	9.0	35	5	60
Area D	65.3	7.5	11.5	30	6	67
Area E	65.1	5.0	9.0	40	5	59
Area F	65.3	5.0	7.5	55	4	58
State Avg. 2005	66.2	6.0	9.3	40	5.0	62
State Avg. 2004	65.8	6.3	11.3	29	5.1	63
SOUTH DAKOTA						
Area A	64.3	6.5	12.5	25	6	71
Area B	64.5	5.5	10.5	35	5	62
Area C	66.0	5.5	7.0	40	4	59
State Avg. 2005	64.9	5.6	9.6	35	4.8	62
State Avg. 2004	64.0	6.3	12.4	26	5.7	71
FOUR-STATE REGION						
Avg. 2005	65.6	5.7	9.9	36	5.1	61
Avg. 2004	64.8	10.9	15.2	25	5.6	69
Five-Year Avg.	64.6	11.5	18.7	24	6.3	n/a

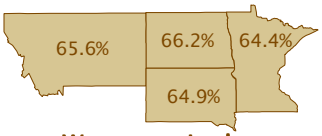
All state and regional averages have been adjusted to reflect production differences.



REFERENCE FARINOGRAMS FOR HARD RED SPRING WHEAT

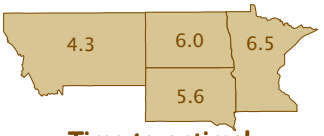


AVERAGE FARINOGRAM ABSORPTION BY STATE



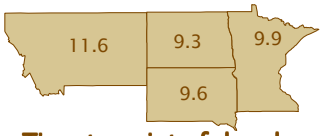
Water required to opitimally develop dough.

AVERAGE PEAK TIME BY STATE (minutes)



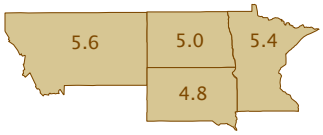
Time to optimal dough development.

AVERAGE STABILITY BY STATE (minutes)



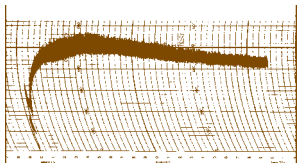
Time to point of dough breakdown.

AVERAGE DOUGH STRENGTH BY STATE



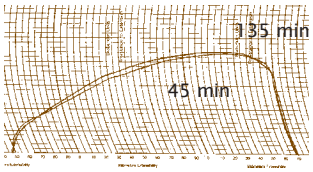
Farinogram classification on a scale of 1 to 8 with higher values indicating strong mixing properties

REGIONAL AVERAGE FARINOGRAM



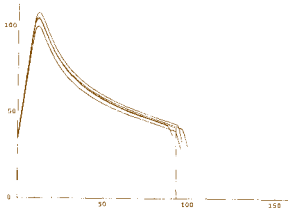
A 5.1 classification indicates medium mixing properties.

REGIONAL AVERAGE EXTENSOGRAM



Indicates extensibility and resistance to extension. Area beneath curve indicates the energy or work required.

REGIONAL AVERAGE ALVEOGRAM

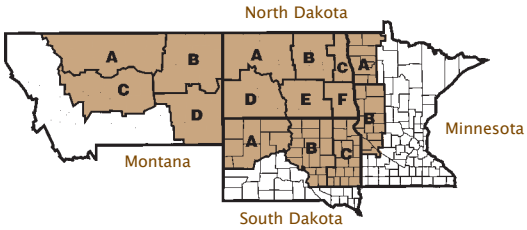


P–Curve height shows maximum pressure needed to deform dough, indicating stability.
L–Length of curve reflects extensibility.
W–Measurement of total energy or work needed to inflate dough.

Physical Dough Properties

STATE AND CROP REPORTING AREA	EXTENSOGRAM						ALVEOGRAM		
	EXTENSIBILITY 45 MIN Cm	RESISTANCE 45 MIN B.U.	AREA sqcm	EXTENSIBILITY 135 MIN cm	RESISTANCE 135 MIN B.U.	AREA sq cm	P mm	L mm	W JoulesX10^{-4}
MINNESOTA									
Area A	20.5	400	108	24.5	350	111	103	100	341
Area B	20.3	485	132	21.1	500	137	91	121	364
State Avg. 2005	20.4	431	117	23.3	404	120	99	108	349
State Avg. 2004	19.5	608	150	17.7	738	159	111	103	416
MONTANA									
Area A	19.5	735	184	19.2	840	203	150	86	509
Area B	18.8	590	145	19.3	570	140	142	83	444
Area C	18.7	600	143	21.6	760	213	155	83	504
Area D	20.7	585	157	20.2	635	173	126	101	470
State Avg. 2005	19.2	660	164	19.4	710	174	146	85	479
State Avg. 2004	21.0	691	181	18.2	800	179	140	98	521
NORTH DAKOTA									
Area A	21.9	435	121	22.1	440	125	126	102	433
Area B	19.6	390	100	23.6	375	118	104	104	356
Area C	20.6	335	90	22.7	310	96	93	107	313
Area D	24.1	510	159	25.2	545	180	113	106	412
Area E	23.1	440	132	20.9	415	113	105	104	365
Area F	21.2	340	98	23.9	320	108	88	118	309
State Avg. 2005	21.5	406	115	23.1	399	123	106	106	367
State Avg. 2004	20.3	517	134	20.1	536	139	128	104	442
SOUTH DAKOTA									
Area A	23.0	525	156	21.7	540	154	115	99	398
Area B	22.3	430	128	23.2	445	131	108	104	360
Area C	22.0	350	98	22.4	340	96	101	96	317
State Avg. 2005	22.3	416	122	22.8	423	123	107	101	351
State Avg. 2004	19.1	510	123	17.7	562	124	108	104	404
FOUR-STATE REGION									
Avg. 2005	21.0	458	125	22.4	461	132	112	102	382
Avg. 2004	20.1	564	144	19.0	624	148	124	103	446
Five-Year Avg.	22.9	520	149	n/a	n/a	n/a	97	115	384

All state and regional averages have been adjusted to reflect production differences.



baking characteristics

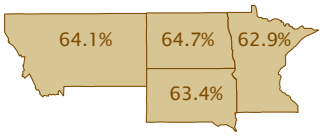
Although consumers make the ultimate judgement, baking tests are the final laboratory method for evaluating wheat quality. In general, a good correlation exists between loaf volume and protein quantity and quality. Laboratory technicians also visually evaluate test loaves for crumb grain, texture and color, as well as crust color and loaf symmetry.

Photo credit: North Dakota Mill

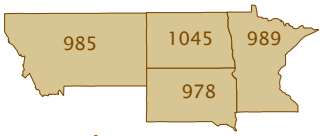
Photo credit: Wheat Foods Council

The gluten strength in flour milled from U.S. hard red spring wheat is essential to supporting the heavy ingredients in many whole grain and artisan breads.

AVERAGE BAKING ABSORPTION BY STATE



AVERAGE LOAF VOLUME BY STATE



Cubic centimeters

Baking Data

STATE AND CROP REPORTING AREA	BAKING ABSORPTION %	DOUGH HANDLING PROPERTIES	LOAF VOLUME CC	GRAIN AND TEXTURE	CRUMB COLOR	CRUST COLOR	SYMMETRY
MINNESOTA							
Area A	64.1	8.0	1000	8.0	8.5	10.0	10.0
Area B	60.9	8.0	970	8.0	8.0	10.0	10.0
State Avg. 2005	62.9	8.0	989	8.0	8.3	10.0	10.0
State Avg. 2004	61.8	10.0	956	8.0	8.0	10.0	10.0
MONTANA							
Area A	63.6	10.0	1030	7.5	8.0	10.0	10.0
Area B	64.7	10.0	930	8.0	8.0	10.0	10.0
Area C	65.5	10.0	1015	8.0	8.0	10.0	10.0
Area D	63.3	9.0	1030	8.0	8.0	10.0	10.0
State Avg. 2005	64.1	10.0	985	7.8	8.0	10.0	10.0
State Avg. 2004	62.5	10.0	1011	7.7	8.2	10.0	9.5
NORTH DAKOTA							
Area A	66.0	8.0	1050	7.0	8.0	10.0	10.0
Area B	65.0	8.0	1025	8.0	8.0	10.0	10.0
Area C	64.8	8.0	1075	7.0	7.5	10.0	10.0
Area D	63.8	9.0	1025	8.0	8.0	10.0	10.0
Area E	63.6	8.0	1055	7.5	8.0	10.0	10.0
Area F	63.8	8.0	1050	7.5	7.5	10.0	10.0
State Avg. 2005	64.7	8.2	1045	7.5	7.8	10.0	10.0
State Avg. 2004	64.1	10.0	1036	7.9	7.8	10.0	9.7
SOUTH DAKOTA							
Area A	62.8	10.0	980	8.5	8.5	10.0	10.0
Area B	63.0	8.0	950	8.5	8.0	10.0	10.0
Area C	64.5	8.0	1030	7.5	8.0	10.0	10.0
State Avg. 2005	63.4	8.2	978	8.2	8.1	10.0	10.0
State Avg. 2004	62.5	10.0	1002	7.9	8.0	10.0	10.0
FOUR-STATE REGION							
Average 2005	64.1	8.5	1015	7.7	8.0	10.0	10.0
Average 2004	63.2	10.0	1012	7.9	8.0	10.0	9.8
Five-Year Avg.	63.1	9.9	1054	8.1	8.2	10.0	9.9

All state and regional averages have been adjusted to reflect production differences.

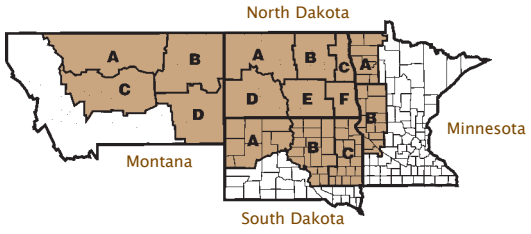
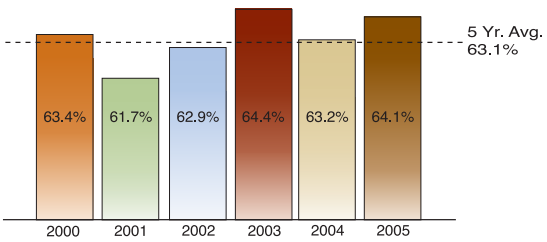


Photo credit: Wheat Foods Council

Photo credit: Wheat Foods Council

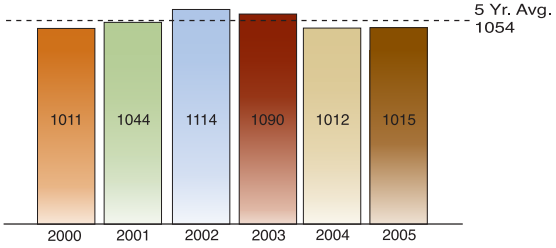
Photo credit: Wheat Foods Council

REGIONAL AVERAGE BAKING ABSORPTION



Average absorption for the four-state region is 64.1 percent, up from last year and average.

REGIONAL AVERAGE LOAF VOLUME (cubic centimeters)



Average loaf volume for the four-state region is 1015 cubic centimeters, similar to 2004 and slightly lower than the five-year average.

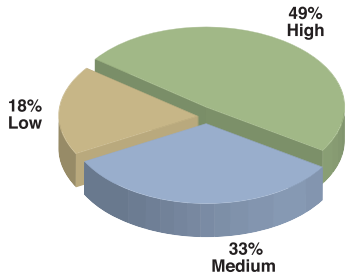
Average Quality Factors for the Regional Hard Red Spring Wheat Crop

	2000	2001	2002	2003	2004	FIVE-YEAR AVERAGE	2005
GRADING AND WHEAT DATA							
Test Weight (lbs/bu)	60.1	59.7	59.1	61.5	61.1	60.3	60.2
Test Weight (kg/hl)	79.1	78.6	77.8	80.8	80.4	79.3	79.1
Vitreous Kernels (%)	68	75	71	82	65	72	68
1000 Kernel Weight (gm)	31.2	29.0	28.7	30.4	32.9	30.4	29.8
Protein:12% moisture (%)	14.4	14.4	15.3	14.0	13.8	14.4	14.6
Protein: dry (%)	16.4	16.4	17.4	16.0	15.6	16.4	16.5
Ash: 14% moisture (%)	1.67	1.71	1.68	1.59	1.55	1.64	1.72
Falling Number (sec)	343	396	334	403	355	366	414
FLOUR DATA							
Flour Extraction (%)	69.4	69.2	69.4	69.6	69.0	69.3	70.0
Ash: 14% moisture (%)	0.47	0.43	0.46	0.42	0.42	0.44	0.53
Protein: 14% moisture (%)	13.2	13.3	14.1	12.8	12.4	13.2	13.4
Wet Gluten (%)	36.4	36.1	36.1	35.8	32.2	35.3	35.2
Falling Number (sec)	374	412	375	421	365	389	418
Amylograph Peak Viscosity							
65g FL (B.U.)	549	703	485	797	549	617	731
100g FL (B.U.)	1947	2575	1783	2824	1813	2188	2547
PHYSICAL DOUGH PROPERTIES:							
Farinograph:							
Absorption (%)	64.9	63.2	64.4	65.9	64.8	64.6	65.6
Peak Time (min)	9.1	10.7	14.8	12.0	10.9	11.5	5.7
Stability (min)	15.5	17.2	24.3	21.1	15.2	18.7	9.9
Classification	5.6 (med)	6.4 (med strong)	7.2 (strong)	6.9 (strong)	5.6 (med strong)	6.3 (med strong)	5.1 (med)
Extensigraph:							
Extensibility–45 min (cm)	22.5	23.5	24.9	23.6	20.1	22.9	21.0
Resistance–45 min (B.U.)	448	532	538	519	564	520	458
Area–45 min (sq cm)	127	154	167	153	144	149	125
Alveograph:							
P (mm)	86	88	90	96	124	97	112
L (mm)	122	118	114	116	103	115	102
W (Joules X 10^{-4})	347	361	380	386	446	384	382
BAKING DATA:							
Absorption (%)	63.4	61.7	62.9	64.4	63.2	63.1	64.1
Dough Handling Properties	9.5	10.0	10.0	10.0	10.0	9.9	8.5
Loaf Volume (cc)	1011	1044	1114	1090	1012	1054	1015
Grain and Texture	7.9	8.0	8.1	8.4	7.9	8.1	7.7
Crumb Color	8.0	8.2	8.2	8.4	8.0	8.2	8.0
Crust Color	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Symmetry	9.6	10.0	10.0	10.0	9.8	9.9	10.0

2005 Regional Quality Factors by Protein Range

	PROTEIN RANGES		
	LOW	MEDIUM	HIGH
PRODUCTION %	18	33	49
WHEAT GRADING DATA			
Test Weight (lb/bu)	61.0	60.2	59.8
Test Weight (kg/hl)	80.2	79.1	78.7
Damage (%)	0.58	1.02	1.10
Foreign Material (%)	0.00	0.00	0.00
Shrunken/Broken (%)	1.60	1.22	2.70
Total Defects (%)	2.18	2.24	3.80
Vitreous Kernels (%)	71.4	61.9	70.9
Grade	1NS	1NS	2NS
WHEAT DATA			
Dockage (%)	1.46	1.11	1.10
Moisture (%)	12.0	12.6	12.2
Protein: 12% moisture (%)	12.8	14.1	15.4
Protein: dry basis (%)	14.5	16.0	17.5
1000 Kernel Wt. (gm)	30.4	30.4	29.2
Ash: 14% moisture (%)	1.72	1.70	1.73
Falling Number (sec)	420	411	405
Sedimentation (cc)	49.8	54.9	61.8
FLOUR DATA:			
Extraction (%)	70.8	71.1	69.4
Protein: 14% moisture (%)	11.6	12.7	14.3
Protein: dry basis (%)	13.5	14.8	16.7
Ash: 14% moisture (%)	0.53	0.53	0.53
Ash: dry basis (%)	0.61	0.61	0.62
Wet Gluten (%)	29.6	33.6	38.6
Falling Number (sec)	404	408	419
Amylograph Viscosity			
65g FL (B.U.)	733	735	732
100g FL (B.U.)	2556	2582	2570
DOUGH PROPERTIES:			
Farinograph:			
Peak Time (min)	3.7	6.6	7.2
Stability (min)	9.4	10.1	9.7
Absorption (%)	63.1	63.7	65.8
Valorimeter	54	68	69
Classification	4.4	5.4	5.4
Alveograph:			
P (mm)	118	98	99
L (mm)	89	114	106
W (erg/gm)	368	365	355
P/L ratio	1.38	0.88	0.92
Extensigraph:			
Resistance-45 min (BU)	524	451	392
Extension-45 min (cm)	9.3	7.9	6.9
Area-45 min (sq cm)	133	131	111
Resistance-135 min (BU)	596	461	396
Extension-135 min (cm)	10.6	8.2	7.0
Area-135 min (sq cm)	146	128	119
BAKING EVALUATION:			
Absorption (%)	61.6	62.2	64.3
Loaf volume (cc)	926	1041	1074
Crumb Grain/Texture	8.0	8.0	7.7

REGIONAL AVERAGE: PRODUCTION DISTRIBUTION BY PROTEIN RANGE



Performance characteristics often improve as buyers increase their protein specifications. To illustrate the correlation between higher protein and other quality parameters, samples of the regional crop were segregated by protein levels (all based on 12 percent moisture content):

- low (less than 13.5 percent),
- medium (13.5 percent to 14.5 percent), and
- high (more than 14.5 percent).

As protein content increased in the 2005 crop, wet gluten, absorption and mixing strength improved. Loaf volume was noticeably higher in both the medium and high protein samples compared to the low protein sample.

Photo credit: David Lipp, Fargo

export cargo sampling

Data contained in previous sections of this report are derived from the testing of samples gathered during harvest from origination points throughout the U.S. hard red spring wheat region. The results provide an assessment of the overall quality of the crop produced in a given year.

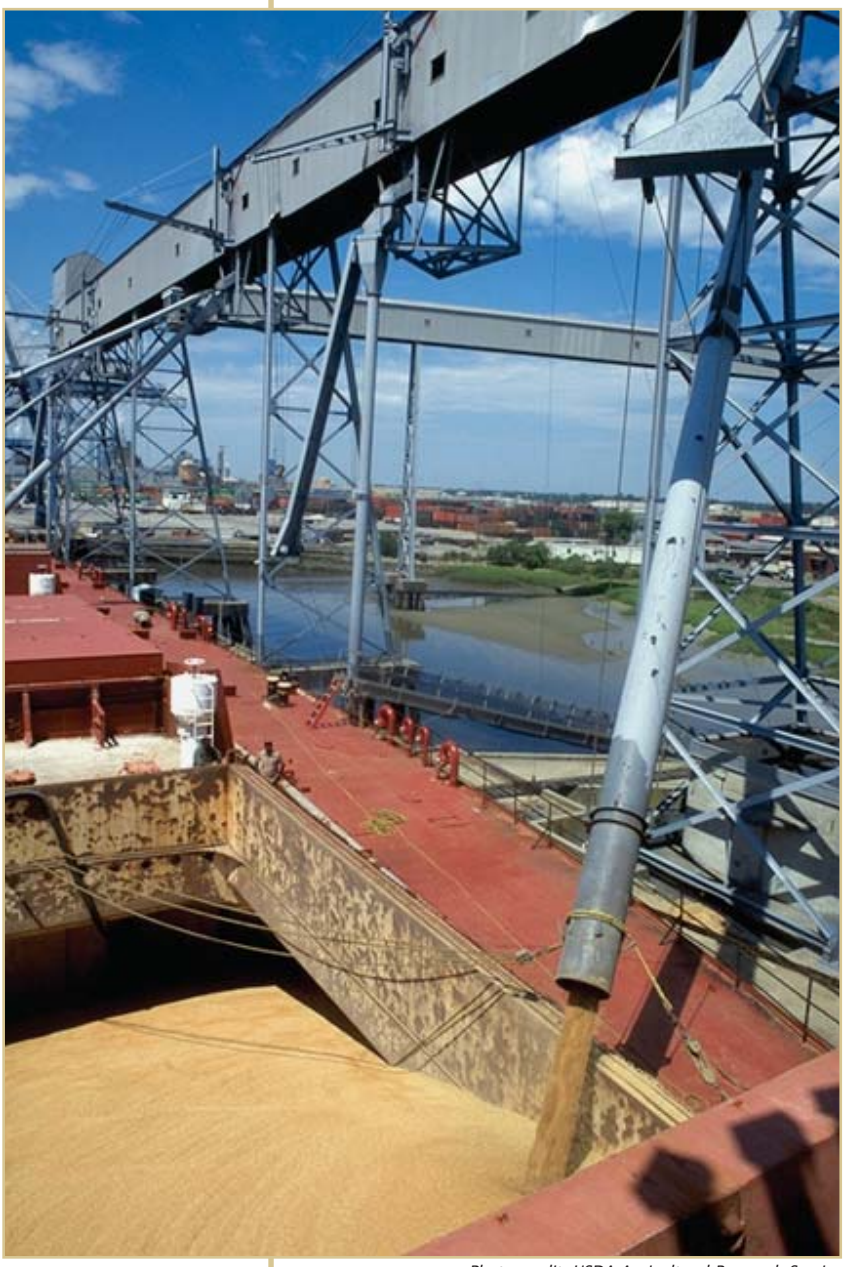


Photo credit: USDA Agricultural Research Service

U.S. Wheat Associates, the export market development arm for American wheat growers, furthers this information by commissioning an export cargo sampling program. The program provides an accurate representation of the supplies moving through the grain marketing and transportation system and actually reaching export points. Results show the quality levels at which U.S. wheat is realistically traded and are useful to customers in developing reasonable purchase specifications.

The Federal Grain Inspection Service oversees the program whereby all export inspection agencies at all ports collect every tenth sublot sample from every vessel of U.S. wheat shipped during three two-month time periods annually.

The hard red spring wheat samples are sent to the North Dakota State University Plant Science Department's Hard Red Spring Wheat Quality Laboratory for analysis. Average results for the past two years are at right.

Export Cargo Data

	PNW AVERAGE		GREAT LAKES AVERAGE		GULF AVERAGE	
	2003	2004	2003	2004	2003	2004
SAMPLE COUNT	151	89	53	55	52	31
GRADING DATA						
Test Weight (lbs/bu)	61.4	61.2	62.3	61.6	62.1	61.3
Test Weight (kg/hl)	80.8	80.5	81.9	80.9	81.7	80.7
Damaged Kernels (%)	0.2	0.6	1.4	1.8	1.2	1.2
Foreign Material (%)	0.1	0.1	0.1	0.1	0.2	0.1
Shrunken & Broken (%)	1.6	1.3	1.0	0.9	1.2	0.9
Total Defects (%)	2.0	2.0	2.5	2.8	2.5	2.2
Vitreous Kernels (%)	83.9	78.2	61.8	43.3	65.8	52.8
Grade	1DNS	1 DNS	1NS	1 NS	1NS	1 NS
OTHER WHEAT DATA						
Dockage (%)	0.3	0.3	0.5	0.5	0.5	0.5
Moisture (%)	10.7	11.7	12.2	13.0	12.2	13.0
Protein: 12% Moisture (%)	14.3	13.9	13.7	13.4	13.9	13.5
Protein: Dry (%)	16.2	15.8	15.6	15.2	15.8	15.4
Ash: 14% Moisture (%)	1.56	1.53	1.58	1.56	1.58	1.57
Ash: Dry (%)	1.81	1.77	1.83	1.81	1.83	1.82
1000 Kernel Weight (g)	32.1	33.4	33.5	33.6	33.2	33.5
Kernel Size (%) lg/md/sm	49/42/8	59/35/5	65/30/5	74/23/3	62/33/5	69/27/4
Single Kernel: Hardness	84.2	79.5	85.0	79.0	83.8	78.7
Weight (mg.)	28.9	31.6	30.0	32.5	29.7	31.8
Diameter (mm)	2.37	2.46	2.43	2.56	2.42	2.51
Falling Number (sec)	437	378	360	331	403	379
FLOUR DATA						
Flour Extraction (%)	69.0	68.3	70.2	69.5	70.1	69.4
Color: L (white-black)	91.2	91.4	91.0	91.1	91.0	91.2
a (red-green)	-1.2	-1.3	-1.3	-1.3	-1.3	-1.4
b (yellow-blue)	9.1	8.9	9.7	9.2	9.6	9.4
Protein: 14% Moisture (%)	13.1	12.6	12.4	12.1	12.7	12.2
Protein: Dry (%)	15.2	14.6	14.4	14.1	14.7	14.1
Ash: 14% Moisture (%)	0.49	0.46	0.48	0.47	0.48	0.45
Ash: Dry (%)	0.57	0.54	0.56	0.55	0.56	0.53
Wet Gluten (%)	34.4	33.5	32.7	30.8	33.3	31.7
Falling Number (sec)	460	405	377	346	418	394
Amylograph Peak Viscosity 65g FL (B.U.)	735	550	474	394	631	531
PHYSICAL DOUGH DATA:						
Farinograph:						
Absorption (%)	66.5	63.8	65.4	64.5	65.0	63.6
Peak Time (min)	10.5	6.5	7.3	4.7	8.0	5.9
Stability (min)	18.5	13.9	14.0	10.9	15.1	12.8
Classification	7.0	6.0	6.0	5.0	6.0	6.0
Alveograph:						
P (mm)	123	123	113	122	109	118
L (mm)	100	102	105	89	107	97
W (Joules X 10^{-4})	442	445	424	399	412	416
BAKING DATA:						
Absorption (%)	65.0	62.6	63.9	63.0	63.5	62.1
Loaf Volume (cc)	1000	994	1008	978	997	971
Crumb Grain and Texture	8.0	8.0	8.0	8.0	8.0	8.0

laboratory analysis

All quality data contained in this report are the result of testing and analysis conducted by or under the supervision of T.C. Olson, R. Olson, and K. McMonagle, food technologists with the Hard Red Spring Wheat Quality Laboratory in the Department of Plant Science at North Dakota State University, Fargo, USA.

COLLECTION The North Dakota, South Dakota, Montana and Minnesota state offices of the National Agricultural Statistics Service obtained wheat samples during harvest directly from growers, farm bins and local elevators. These samples reflect the condition of the grain at the point of origin. Collection began in mid-July in South Dakota when approximately 10 to 15 percent of the hard red spring wheat had been harvested and continued until early September when about 95 percent of the region's crop was harvested.

Sample collection was weighted by county production histories with a total of 811 samples being collected during harvest from Minnesota (110), Montana (194), North Dakota (380), and South Dakota (127).

Photo credit: David Lipp, Fargo

ANALYSIS Approximately 40 percent of the total wheat samples collected were analyzed for grade and other physical kernel characteristics. Distributions as a percentage of the harvested crop were calculated for key factors including test weight, thousand kernel weight, protein, falling number, and overall grade. Distribution results may differ from data presented in the various tables, because the latter are derived from production adjusted averages, rather than simple averages.

Quality tests, including milling, flour evaluation, physical dough and bread properties, were conducted on composite samples representing each crop reporting area. Again, all state and regional averages have been adjusted to reflect production as opposed to simple averaging.

Photo credit: North Dakota Mill

WHEAT

SAMPLE COLLECTION Each sample contained approximately 2 to 3 pounds of wheat, stored in securely closed, moisture proof plastic bags.

MOISTURE Official USDA procedure using Motomco Moisture Meter.

GRADE Official United States Standards for Grain, as determined by a licensed grain inspector. North Dakota Grain Inspection Service, Fargo, ND, provided grades for composite wheat samples representing each crop reporting area.

VITREOUS KERNELS Approximate percentage of kernels having vitreous endosperm.

DOCKAGE Official USDA procedure. All matter other than wheat which can be removed readily from a test portion of the original sample by use of an approved device (Carter Dockage Tester). Dockage may also include underdeveloped, shriveled and small pieces of wheat kernels removed in properly separating the material other than wheat and which cannot be recovered by properly rescreening or recleaning.

TEST WEIGHT American Association of Cereal Chemists Method 55-10 approved April 1961, revised October 1999. Measured as pounds per bushel (lb/bu), Kilograms per hectoliter (Kg/hl) = (lbs/bu X 1.292) + 1.419. *Approved Methods of the American Association of Cereal Chemists, Cereal Laboratory Methods (10th Edition), St. Paul, MN (2000).

THOUSAND KERNEL WEIGHT Based on 10 gram sample of cleaned wheat (free of foreign material and broken kernels) counted by electronic seed counter.

KERNEL SIZE DISTRIBUTION Percentages of the size of kernels (large, medium, small) were determined using a wheat sizer equipped with the following sieve openings:

- top sieve—Tyler #7 with 2.92 mm opening;
- middle sieve—Tyler #9 with 2.24 mm opening; and
- bottom sieve—Tyler #12 with 1.65 mm opening.

PROTEIN American Association of Cereal Chemists (AAC) Method: 46-30 (Combustion Method), expressed on dry basis and 12 percent moisture basis.

ASH American Association of Cereal Chemists Method 08-01, approved April 1961, revised October 1999; expressed on a 14 percent moisture basis.

FALLING NUMBER American Association of Cereal Chemists Method 56-81B, approved November 1972, revised September 1999; units of seconds (14 percent moisture basis).

SEDIMENTATION American Association of Cereal Chemists Method 56-61A, expressed in centimeters. Approved Methods of the American Association of Cereal Chemists, (8th Edition), St. Paul, MN (1983).

Photo credit: USDA Agricultural Research Service

FLOUR

EXTRACTION

Thoroughly cleaned wheat is tempered to 15.5 percent moisture for 16 hours and an additional 0.5 percent water is added five minutes prior to milling. The milling laboratory is controlled at 68 percent relative humidity and 72°F to 74°F. Milling is performed on a Buhler laboratory mill (Type MLU-202). Straight grade flour (of all six flour streams) is blended and reported as "flour extraction." The blended flour is rebolted through an 84 SS sieve to remove any foreign material. This product is used for the other flour quality determinations.

ASH American Association of Cereal Chemists Method 08-01, approved April 1961, revised October 1999; expressed on a 14 percent moisture basis.

PROTEIN American Association of Cereal Chemists (AACC) Method 46-30 (Combustion Method), expressed on a 14 percent moisture basis.

WET GLUTEN American Association of Cereal Chemists Method 38-12, approved October 1999; expressed on a 14 percent moisture basis determined with the glutomatic instrument.

FLOUR FALLING NUMBER American Association of Cereal Chemists Method 56-81B, approved November 1972, revised September 1992; units of seconds. Determination is performed on 7.0 g of Buhler milled flour (14 percent moisture basis).

AMYLOGRAM (100 g) American Association of Cereal Chemists Method 22-10. Peak viscosity reported in Brabender units (B.U.), on a 14 percent moisture basis.

(65 g) American Association of Cereal Chemists Method 22-10, modified as follows: 65 g of flour (14 percent moisture basis) are slurried in 450 ml distilled water, paddle stirrers are used with the Brabender Amylograph. Peak viscosity reported in Brabender units (B.U.), on a 14 percent moisture basis.

STARCH DAMAGE American Association of Cereal Chemists Method 76-31. Proportion of starch granules that have incurred physical damage from milling.

PHYSICAL DOUGH PROPERTIES

FARINOGRAM American Association of Cereal Chemists Method 54-21; constant flour weight method, small (50 g) mixing bowl. (Flour weight 14 percent moisture basis)

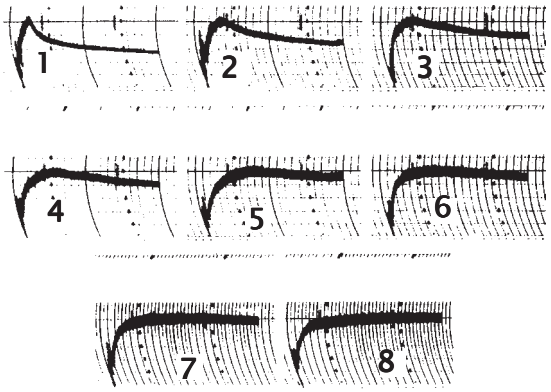
Absorption Amount of water required to center curve peak on the 500 Brabender unit line, expressed on 14 percent moisture basis.

Peak Time The interval, to the nearest 0.5 min, from the first addition of water to the maximum consistency immediately prior to the first indication of weakening. Also known as dough development time.

Stability The time interval, to the nearest 0.5 min, between the point where the top of the curve that first intersects the 500-BU line and the point where the top of the curve departs the 500-BU line.

Mixing Tolerance Index The difference, in Brabender units, from the top of the curve at the peak to the top of the curve measured five minutes after the peak.

REFERENCE FARINOGRAMS FOR HARD RED SPRING WHEAT



Valorimeter Value An empirical, single-figure quality score based on the development time and tolerance to mixing. Derived from the farinogram by means of a special template supplied by the equipment manufacturer. Generally, stronger flours have higher valorimeter values.

Classification An empirical classification incorporating peak time, stability, MTI, and general curve characteristics. A scale of 1 to 8 is employed with higher values indicating stronger curve types.

EXTENSIGRAM American Association of Cereal Chemists Method 54-10, approved April 1961, revised October 1982; modified as follows: (a) 100 grams of flour (14 percent moisture basis), 2.0 percent sodium chloride (U.S.P.) and water (equal to farinograph absorption minus 2 percent) are mixed to optimum development in a National pin dough mixer; (b) doughs are scaled to 150 grams, rounded, moulded, placed in extensigram holders, and rested for 45 minutes and 135 minutes, respectively, at 30°C and 78 percent relative humidity. The dough is then stretched as described in the procedure referenced above. For conversion purposes, 500 grams equals 400 B.U.

Extensibility Total length of the curve at the base line in centimeters.

Resistance Maximum curve height, reported in Brabender units (B.U.).

Area The area under the curve is measured and reported in square centimeters.

ALVEOGRAPH International Association of Cereal Chemists Standard No. 121. Measurement of dough extensibility and resistance to extension.

"P" Maximal overpressure; related to dough's resistance to deformation.

"L" Dough extensibility.

"W" The "work" associated with dough deformation.

BAKING

PROCEDURE American Association of Cereal Chemists Method 10-09, approved September 1985; modified as follows: (a) fungal amylase (SKB 15) replacing malt dry powder, (b) Instant dry yeast (1 percent) in lieu of compressed yeast, (c) 5 to 10 ppm bromate, where added oxidants are required, (d) 2 percent shortening added. Doughs are mechanically punched using 6-inch rolls, and mechanically moulded using a National "Roll-R-Up" moulder. Baking is accomplished in "Shogren-type" pans.

BAKING ABSORPTION Water required for optimum dough baking performance, expressed as a percent of flour weight on a 14 percent moisture basis.

DOUGH CHARACTER Handling characteristics assessed at panning on a scale of 1 to 10 with higher scores preferred.

LOAF VOLUME Rapeseed displacement measurement made 30 minutes after bread is removed from the oven.

CRUMB GRAIN AND TEXTURE Visual comparison to standard using a constant illumination source. Scale of 1 to 10, the higher scores preferred.

Photo credit:
NDSU Cereal Science Department

CRUMB COLOR Visual comparison with a standard using a constant illumination source on a scale of 1 to 10, the higher scores preferred.

CRUST COLOR Visual comparison with a standard using a constant illumination source on a scale of 1 to 10, the higher scores preferred.

SYMMETRY Visual comparison with a standard using a constant illumination source on a scale of 1 to 10, the higher scores preferred.

Photo credit: David Lipp, Fargo

varietal information

Quality products begin with quality ingredients. In wheat, quality begins with the varieties planted. Within the hard red spring class of wheat, there are different varieties available — all with relatively uniform characteristics.

Spring wheat variety development is carried out at experiment stations at North Dakota State University in Fargo, the University of Minnesota in St. Paul, South Dakota State University in Brookings, and Montana State University in Bozeman. Public plant breeders at these experiment stations develop and release most of the hard red spring wheat varieties available in the United States, although more private firms are developing spring wheat breeding programs.

Before any spring wheat variety is released to the public, it must meet or exceed current standards for the class. Prospective variety releases are evaluated for milling and baking characteristics as well as for yield, protein content, test weight, resistance to diseases and insects, and straw strength.

Popular and New Hard Red Spring Wheat Varieties

GROWN & TESTED IN NORTH DAKOTA

VARIETY	AGENT[1] OR ORIGIN	YEAR RELEASED	REACTION TO DISEASE[2] LEAF RUST	FOLIAR DISEASE	HEAD (SCAB)	AVERAGE YIELD EASTERN[3] NORTH DAKOTA BU/ACRE	MT/HA	WESTERN[4] NORTH DAKOTA BU/ACRE	MT/HA	END-USE[5] GLUTEN STRENGTH DESCRIPTION[6]	MILL & BAKE QUALITY RATING[7]
Alsen	ND	2000	MR	S	MR	71.5	4.81	59.4	3.99	traditional strong	★★★★
Briggs	SD	2002	R	MS	S	82.8	5.57	63.3	4.26	traditional strong	★★★
Freyer	AgriPro	2004	M	MS/S	MR	72.4	4.87	61.2	4.11	traditional strong	★★★
Glenn	ND	2005	R	M	MR	n/a	n/a	n/a	n/a	traditional strong	★★★★★
Granite	WPB	2002	MR	S	MS	69.4	4.67	58.8	3.95	traditional strong	★★★
Knudson	AgriPro	2001	MR	M	M	78.0	5.24	62.6	4.21	extra strong	★★★
McNeal	MT	1995	MS	n/a	S	n/a	n/a	n/a	n/a	extra strong	★★★★
Norpro	AgriPro	1999	MS/MR	M	MS	76.5	5.14	63.1	4.24	mellow	★★
Oklee	MN	2003	MS	MR	M	73.2	4.92	n/a	n/a	mellow	★★
Oxen	SD	1996	MS	S	S	67.8	4.56	57.5	3.87	traditional strong	★★★★
Parshall	ND	1999	MS	M	M	69.2	4.65	61.7	4.15	traditional strong	★★★★★
Reeder	ND	1999	MS	M	S	68.6	4.61	64.5	4.34	traditional strong	★★★
Steele ND	ND	2004	R	MR	M	80.2	5.39	60.9	4.09	tradtional strong	★★★

1 ND=North Dakota State University (Public), SD=South Dakota State University (Public), MN=University of Minnesota (Public), MT=Montana State University (Public), AgriPro (Private), WPB=Western Plant Breeders (Private)

*2 Reaction to Disease: resistant (R), moderately resistant (MR), intermediate (M), moderately susceptible (MS), susceptible (S), very susceptible (VS). *Indicates yield and/or quality have often been higher than would be expected based on visual head blight symptoms alone.*

3 2004 North Dakota yield data from Fargo, Carrington and Langdon research test plots.

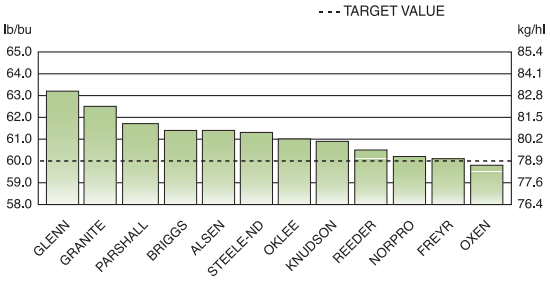
4 2004 North Dakota yield data from Minot, Williston, Dickinson and Hettinger research test plots.

5 Source: NDSU Plant Science Department, Hard Red Spring Wheat Quality Laboratory, multi-year analysis of field plot trials in multiple locations across North Dakota.

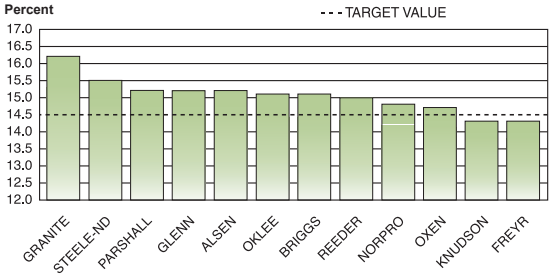
6 Traditional Strong—functionality characteristic of hard red spring wheat; relatively quick mixing time, long mixing stability and tolerance to over-mixing.
Extra Strong—stronger than traditional hard red spring wheat varieties; longer mixing time and very long mixing stability.
Mellow—weaker than "traditional strong" varieties; shorter mixing time and stability.

7 Mill and bake quality rating based on protein content, milling performance, flour attributes, dough characteristics and baking performance. Five stars = superior, four stars = very good, three stars = good, two stars = average, one star = poor.

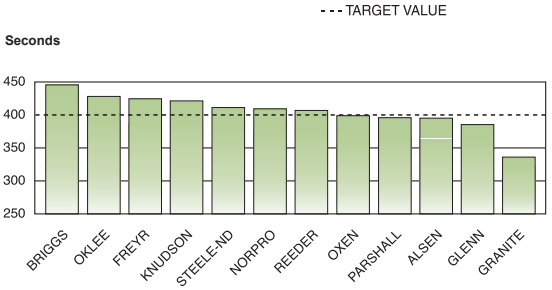
TEST WEIGHT COMPARISON



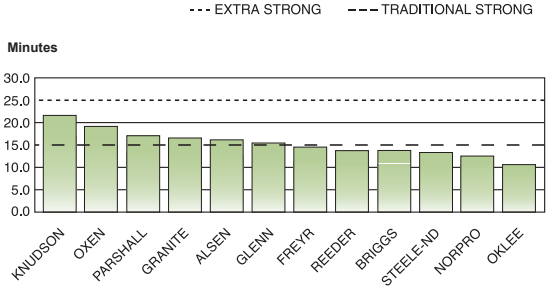
WHEAT PROTEIN CONTENT COMPARISON (12% moisture basis)



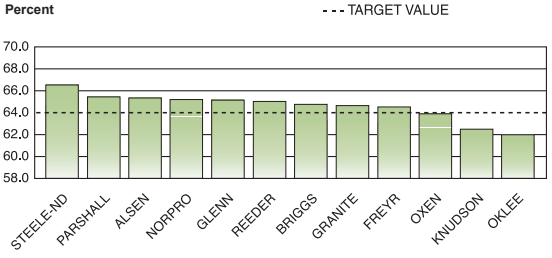
WHEAT FALLING NUMBER COMPARISON



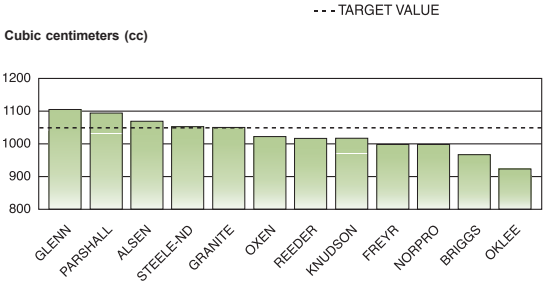
FARINOGRAPH STABILITY COMPARISON



FARINOGRAPH ABSORPTION COMPARISON (14% moisture basis)



LOAF VOLUME COMPARISON



Source: NDSU Plant Science Department, Hard Red Spring Wheat Quality Laboratory, average of 2003 and 2004 field plot trials. The Montana variety McNeal is not shown in these comparisons because it is not grown in the same experimental field plots.

Target values represent regionally agreed upon goals of public and private variety development programs.

Environment influences the quality of varieties across growing areas and planting years. For this reason, wheat breeders use "check" or reference varieties to evaluate quality in experimental varieties. They usually test and analyze quality data from multiple years and growing locations before a variety is released.

Leading varieties of hard red spring wheat in commercial production generally meet or exceed target values for key quality parameters.

NORTH DAKOTA

The North Dakota Agricultural Statistics Service reports leading varieties in 2005 are Alsen, Reeder, Briggs, Granite and Knudson. Of the 6.8 million acres of spring wheat planted in North Dakota, the top five varieties account for 66 percent.

ALSEN is again the most popular variety in North Dakota, but its share of acreage decreased from 29 percent to 23 percent. Alsen continues to be dominant in northern areas because of its moderate resistantance to Fusarium headblight. Alsen has a competitive yield and very good milling and baking quality.

REEDER is the second ranked variety in North Dakota and Montana. It is primarily planted from northeast Montana to southwest North Dakota. Reeder is a high yielding variety for western areas. It has good milling and baking quality.

BRIGGS made the largest gain in North Dakota acres. It is also popular in South Dakota and fifth in Minnesota. It was the leading variety in southeast North Dakota, favored for its yield and leaf rust resistance.

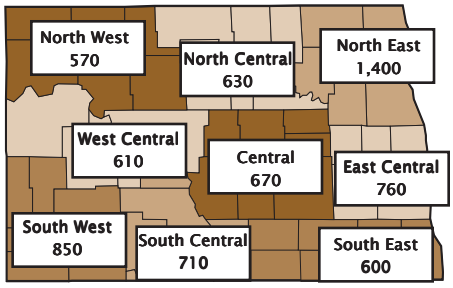
GRANITE climbed to fourth and was the leading variety in North Dakota's east central district where its staw strength is desired for more intensive input practices. Granite has good milling and baking quality.

SPRING WHEAT VARIETIES PLANTED ACRES IN NORTH DAKOTA

VARIETY	2004 %[1]	2005 %[1]	2005 ACRES (1,000)
Alsen	28.9	23.1	1,572.0
Reeder	13.3	16.2	1,102.6
Briggs	7.6	12.7	864.9
Granite	3.4	7.3	494.8
Knudson	6.7	6.7	453.9
Parshall	7.1	5.8	394.3
Norpro	4.6	3.2	214.7
Oxen	4.4	2.6	173.7
Freyr	0.0	1.6	108.5
Hanna	0.9	1.6	107.5
Steele ND	0.0	1.4	98.5
Oklee	0.3	1.4	93.1
Dapps	0.0	1.2	83.4
Grandin	1.5	1.2	80.3
Gunner	1.7	1.1	72.9
Other[2]	19.5	12.8	884.9

1/Percentages may not add to 100 due to rounding. 2/Includes varieties with less than 1% of acreage in 2005 and unknown varieties.

NORTH DAKOTA AGRICULTURAL STATISTICS DISTRICTS 2005 PLANTED AREA (1,000 ACRES)



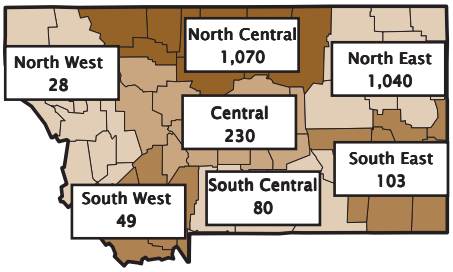
SPRING WHEAT VARIETIES IN NORTH DAKOTA SHARE OF 2005 SEEDED ACRES BY CROP DISTRICT

VARIETY	NORTH WEST	NORTH CENTRAL	NORTH EAST	WEST CENTRAL	CENTRAL	EAST CENTRAL	SOUTH WEST	SOUTH CENTRAL	SOUTH EAST	STATE
					PERCENTAGE (%)[1]					
Alsen	43.1	44.9	28.1	27.5	31.7	18.6	4.2	3.7	11.2	23.1
Reeder	11.5	5.4	1.9	29.3	3.8	3.3	57.1	31.2	6.5	16.2
Briggs	0.0	12.9	17.9	0.0	24.5	15.1	3.7	6.1	30.0	12.7
Granite	0.0	2.7	17.1	1.0	5.3	19.7	1.0	1.4	4.8	7.3
Knudson	6.3	8.9	5.7	5.2	12.0	8.4	0.1	10.0	5.8	6.7
Parshall	13.8	3.3	5.6	6.2	3.9	2.5	7.3	8.6	1.9	5.8
Norpro	3.0	0.9	0.8	1.1	3.0	4.6	5.0	5.8	5.9	3.2
Oxen	0.0	0.0	0.2	2.7	0.2	4.4	2.0	3.7	12.8	2.6
Freyr	1.4	2.0	1.4	1.6	2.4	2.6	1.1	0.4	1.7	1.6
Hanna	2.1	2.4	4.9	0.0	1.5	0.0	0.2	0.1	0.0	1.6
Steele ND	2.3	2.3	1.4	1.3	2.3	1.2	0.9	0.6	1.1	1.4
Oklee	0.0	0.0	4.1	0.0	0.8	3.5	0.0	0.0	0.6	1.4
Dapps	0.9	4.1	0.4	1.0	1.3	0.0	0.7	1.1	2.9	1.2
Grandin	1.2	0.3	0.7	3.2	0.0	1.0	2.4	2.1	0.0	1.2
Gunner	2.8	2.7	0.7	0.2	0.1	0.6	1.9	0.9	0.0	1.1
Other[2]	11.7	7.3	9.1	19.7	7.0	14.4	12.4	24.3	14.9	12.8
					1,000 ACRES					
All Varieties	570	630	1,400	610	670	760	850	710	600	6,800

1/Columns may not add to 100 due to rounding. 2/Includes varieties with less than 1% of acreage in 2005 and unknown varieties.

Photo credit: David Lipp, Fargo

MONTANA AGRICULTURAL STATISTICS DISTRICTS 2005 PLANTED AREA (1,000 ACRES)



SPRING WHEAT VARIETIES PLANTED ACRES IN MONTANA

VARIETY	2004 %[1]	2005 (%[1]	2005 ACRES 1,000)
McNeal	31.7	28.8	748.2
Reeder	21.8	23.6	613.2
Ernest	10.2	11.5	298.6
Conan	7.3	8.0	208.2
Fortuna	4.7	6.5	167.9
Hank	1.8	2.4	60.8
Amidon	2.9	2.2	58.6
Scholar	2.3	1.6	43.4
Lew	2.4	1.6	40.9
Choteau		1.6	40.9
Westbred Rambo	3.2	1.3	32.5
Westbred 936	1.0	1.1	28.6
Other[2]	8.6	9.8	258.2

1/Percentages may not add to 100 due to rounding. 2/Includes varieties with less than 1% of acreage in 2005 and unknown varieties.

SPRING WHEAT VARIETIES IN MONTANA SHARE OF 2005 SEEDED ACRES BY CROP DISTRICT

VARIETY	NORTH WEST	NORTH CENTRAL	NORTH EAST	CENTRAL	SOUTH WEST	SOUTH CENTRAL	SOUTH EAST	TOTAL STATE
				PERCENTAGE (%)[1]				
McNeal	16.8	22.3	30.5	40.4	47.1	53.9	27.8	28.8
Reeder	1.1	1.0	50.1	22.5	0.0	7.5	22.7	23.6
Ernest	0.0	21.7	4.7	4.8	0.0	2.7	4.2	11.5
Conan	0.0	18.9	0.4	0.8	0.0	0.0	0.0	8.0
Fortuna	0.0	14.0	0.4	3.3	0.0	7.9	0.0	6.5
Hank	21.8	2.4	0.4	4.4	19.8	6.2	0.0	2.4
Amidon	2.5	0.9	4.3	0.1	0.0	0.4	3.0	2.2
Scholar	0.0	2.8	0.8	2.2	0.0	0.0	0.0	1.6
Lew	0.0	3.1	0.5	0.3	0.0	0.0	1.7	1.6
Choteau	0.0	2.6	0.9	1.6	0.0	0.0	0.0	1.6
Westbred Rambo	0.0	2.9	0.1	0.2	0.0	0.0	0.0	1.3
Westbred 936	0.4	0.5	0.0	5.5	11.0	0.0	5.0	1.1
Other & Unknown	57.4	6.9	6.9	13.9	22.1	21.4	35.6	9.8
				1,000 ACRES				
All Varieties	28	1,070	1,040	230	49	80	103	2,600

1/Columns may not add to 100 due to rounding. 2/Includes varieties with less than 1% of acreage in 2005 and unknown varieties.

MONTANA

Montana Agricultural Statistics Service reports the most popular varieties of hard red spring wheat planted in the state in 2005 are McNeal, Reeder, Ernest, Conan and Fortuna. Of 2.6 million acres planted, these five varieties account for 78 percent.

MCNEAL remains the top variety with 29 percent of acres and broad appeal statewide. It has moderate resistance to wheat streak mosaic virus, average test weight, slightly less than average protein, yet uniquely extra strong dough characteristics.

ERNEST is third with a slight increase in acreage to 12 percent. It is most popular in the north central district because it is a solid stem variety resistant to wheat stem sawfly. Ernest has high test weight and protein.

CONAN, a 1999 release from Western Plant Breeders, is fourth with 8 percent of acres, primarily in north central area. Growers value its sawfly tolerance and stripe and leaf rust resistance. Conan has good protein and average milling and baking traits.

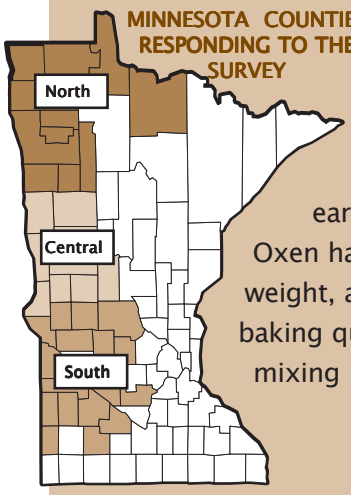
FORTUNA, a 1966 joint release from North Dakota and Montana, has regained popularity in central Montana because of its solid-stem resistance to sawfly. It is relatively high yielding and has very good milling and baking properties.

MINNESOTA & SOUTH DAKOTA

A Minnesota Wheat Research and Promotion Council unofficial survey indicates most popular varieties are Oxen, Knudson, Oklee, Granite and Briggs.

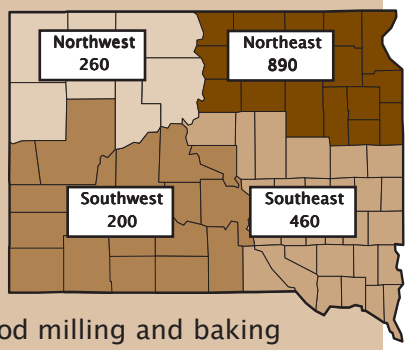
A South Dakota Agricultural Statistics Service survey shows leading varieties are Briggs, with nearly a third of acres, followed by Oxen, Forge and Russ, all South Dakota State University releases.

MINNESOTA COUNTIES RESPONDING TO THE SURVEY



OXEN is the top variety in Minnesota and second in South Dakota due to its early- to mid-season maturity. Oxen has average protein and test weight, and very good milling and baking quality with strong dough mixing properties.

SOUTH DAKOTA AGRICULTURAL STATISTICS DISTRICTS
2005 PLANTED AREA (1,000 ACRES)



KNUDSON remains second in Minnesota with 16 percent of acres, and fifth in North Dakota with 7 percent of acres. It has high yield and intermediate resistance to Fusarium headblight, plus very good milling and baking qualities with extra strong gluten characteristics.

OKLEE made sharp gains to move to third in Minnesota with 10 percent of acreage. It has intermediate resistance to Fusarium headblight and moderate resistance to leaf disease, allowing for competitive yields in eastern areas.

FORGE is early maturing, highly adaptable to the southern region, with medium protein, good test weight and mellow mixing properties.

SPRING WHEAT VARIETIES
SHARE OF 2005 MINNESOTA ACRES

VARIETY	NORTH %[1]	CENTRAL %[1]	SOUTH %[1]	TOTAL STATE[3] %[1]
Oxen	6.4	29.9	40.7	17.0
Knudson	14.5	18.4	10.8	16.0
Oklee	11.3	9.0	12.2	10.3
Granite	10.3	9.6	11.8	10.0
Briggs	14.3	2.3	1.9	9.0
Alsen	12.4	4.5	0.6	8.8
Reeder	9.4	3.9	2.2	7.0
Walworth	3.2	4.8	5.0	3.9
Freyr	2.8	2.5	1.8	2.7
Parshall	3.3	1.5	0.0	2.5
Express	0.7	3.3	0.8	1.8
Banton	2.2	1.0	1.6	1.7
Trooper	1.6	0.8	0.0	1.3
Polaris	1.2	1.1	0.0	1.1
Other[2]	6.5	7.5	10.6	7.0

1/Columns may not add to 100 due to rounding. 2/Includes varieties with less than 1% of acreage in 2005 and unknown varieties. 3/ Producer esponse rate covered 41 percent of estimated 1.8 million planted acres.

SPRING WHEAT VARIETIES IN SOUTH DAKOTA
SHARE OF 2005 SEEDED ACRES BY CROP DISTRICT

VARIETY	NORTH WEST %[1]	NORTH EAST %[1]	SOUTH WEST %[1]	SOUTH EAST %[1]	TOTAL STATE[3] %[1]	STATE ACRES[4] (1,000)
Briggs	9.9	39.6	13.3	26.5	29.1	524.1
Oxen	14.5	13.0	16.7	9.5	12.8	229.5
Forge	10.9	3.7	19.6	17.2	9.9	178.2
Russ	11.7	6.1	6.3	12.5	8.5	153.8
Reeder	18.1	7.0	0.9	0.2	6.2	112.0
Walworth	0.3	3.1	3.3	11.4	4.8	86.3
Granger	2.2	4.9	2.2	1.2	3.3	59.0
Norpro	1.3	3.6	0.3	1.6	2.4	43.2
Ingot	1.0	1.9	0.0	4.4	2.2	39.0
Butte 86/Butte	5.9	1.1	3.5	1.2	2.1	37.6
Knudson	0.0	3.5	0.1	1.0	2.0	35.9
Mercury	0.0	3.0	0.0	0.0	1.5	26.8
Other[2]	24.1	9.5	34.0	13.3	15.3	274.6
			1,000 ACRES[4]			
All Varieties	260	890	200	450	1,800	

1/Columns may not add to 100 due to rounding. 2/Includes varieties with less than 1% of acreage in 2005 and unknown varieties. 3/South Dakota only conducts a variety survey every third year so no comparison to last year is available. 4/Based on June survey estimating 1.8 million acres planted. USDA's Sept. report estimates final planted acres at 1.75 million acres.

handling & transportation

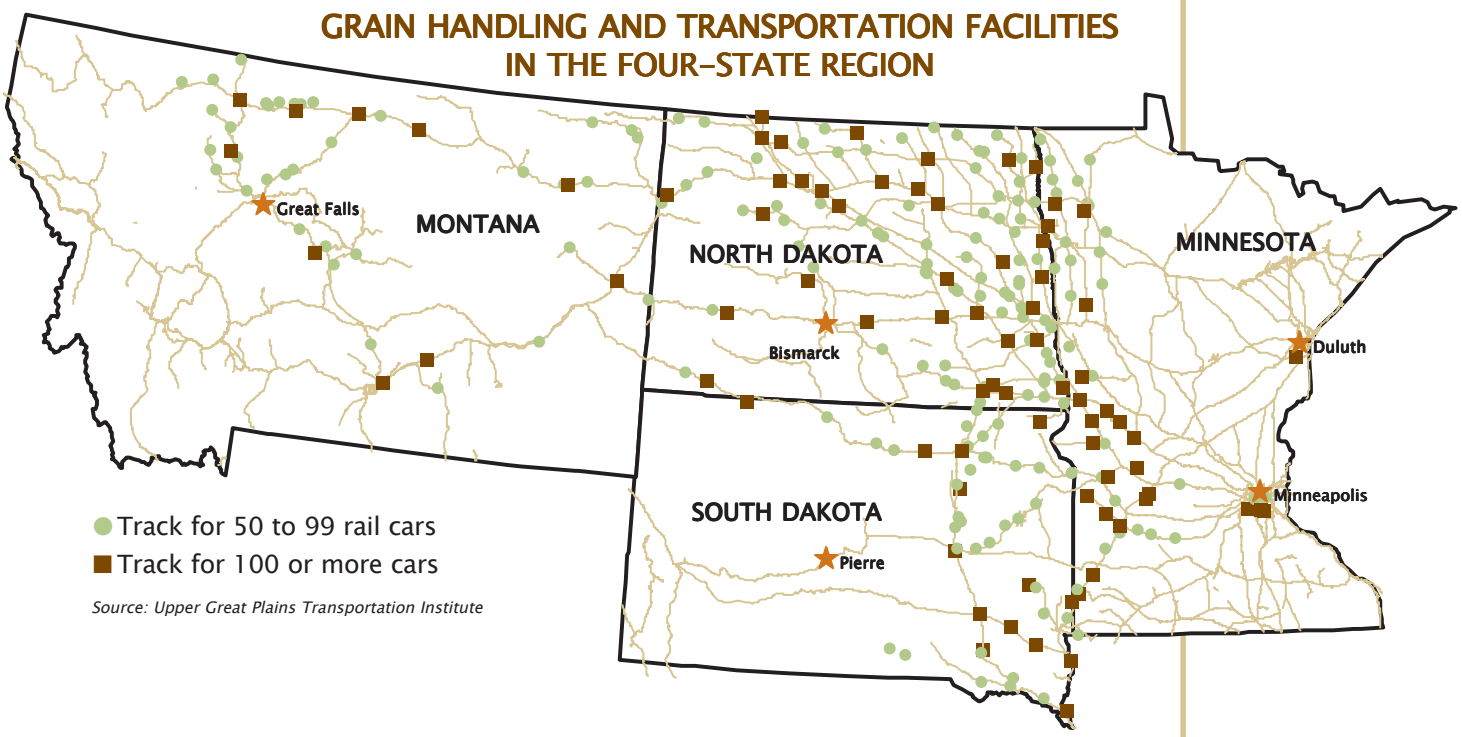
The hard red spring wheat growing region in the Northern Plains has a vast network of country elevators to facilitate efficient and precise movement to domestic and export markets. On average, nearly 80 percent of the region's wheat moves to markets by rail. Duluth is the only export market serviced by a greater share of trucks. Shipments to the Pacific Northwest and Gulf export markets are almost entirely by rail, with some barge movement to the Gulf. The dominant railroad is the Burlington Northern Santa Fe, followed by the Canadian Pacific.

A majority of the elevators in the region have the ability to ship 50 railcar units, with several equipped to ship 100 car units. Each rail car holds approximately 3,500 bushels (95 metric tons) of wheat. Some of the 100-car shippers have invested in "shuttle" capabilities. Shuttle-equipped facilities receive the lowest rates, sharing volume and transaction efficiencies with the railroad.

The diverse rail shipping capacities and widespread network of elevators are strengths buyers can capitalize on, especially as their demand heightens for more precise quality specifications and consistency between shipments. Buyers are increasingly exploring origin-specific shipments. Many international buyers now find it possible to request wheat from certain locations to optimize the quality and value of wheat they purchase.

The rail and elevator network in the U.S. hard red spring wheat region is well suited for meeting the increasing quality demands of both domestic and international customers.

GRAIN HANDLING AND TRANSPORTATION FACILITIES IN THE FOUR-STATE REGION



Source: Upper Great Plains Transportation Institute

North Dakota Wheat Commission

Montana Wheat and Barley Committee

Minnesota Wheat Research and Promotion Council

South Dakota Wheat Commission

U.S. Wheat Associates

FUNDING & SUPPORT